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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>6</sup> : <b>H04N 7/173</b></p>	<b>A1</b>	<p>(11) International Publication Number: <b>WO 98/09440</b></p> <p>(43) International Publication Date: <b>5 March 1998 (05.03.98)</b></p>						
<p>(21) International Application Number: <b>PCT/US97/15446</b></p> <p>(22) International Filing Date: <b>2 September 1997 (02.09.97)</b></p> <p>(30) Priority Data:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">60/024,953</td> <td style="width: 33%;">30 August 1996 (30.08.96)</td> <td style="width: 33%;">US</td> </tr> <tr> <td>08/732,167</td> <td>16 October 1996 (16.10.96)</td> <td>US</td> </tr> </table> <p>(71) Applicant: <b>DSC TELECOM L.P. [US/US]; 1000 Coit Road, Plano, TX 75075 (US).</b></p> <p>(72) Inventors: <b>LEWIS, Stephen; 7500 Silverado Trail, Napa, CA 94558 (US). STEVENSON, K., Martin, III; 7 Cabrillo Court, San Rafael, CA 94903 (US). NABAVI, Farzad, S.; 4346 Palmdale Street, Union City, CA 94587 (US).</b></p> <p>(74) Agent: <b>FISH, Charles, S.; Baker &amp; Botts, L.L.P., 2001 Ross Avenue, Dallas, TX 75201-2980 (US).</b></p>			60/024,953	30 August 1996 (30.08.96)	US	08/732,167	16 October 1996 (16.10.96)	US
60/024,953	30 August 1996 (30.08.96)	US						
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<p>(81) Designated States: <b>AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</b></p> <p><b>Published</b> <i>With international search report.</i></p>								
<p>(54) Title: <b>METHOD OF DELIVERING VIDEO INFORMATION OVER A TELECOMMUNICATIONS NETWORK</b></p> <p>(57) Abstract</p> <p>A video telecommunications delivery network (10) provides video channels to a plurality of set top units (24). Each set top unit sends a video channel request to an associated cell multiplexing unit (20). If the video channel is available, the cell multiplexing unit (20) provides the video channel to the set top unit (22). If the requested video channel is not available, the cell multiplexing unit (20) passes the request to an associated cell routing unit (18). The cell routing unit (18) provides the requested video channel to the set top unit (22) according to availability. If unavailable, cell routing unit (18) provides the video channel request to a digital multicast bank (16). Digital multicast bank (16) delivers the requested video channel if available, otherwise the video channel request is routed to a video information provider (12) through an asynchronous transfer mode (ATM) switch (14). The video information provider (12) delivers the requested video channel to the digital multicast bank (16) through the ATM switch (14) for ultimate delivery to a video subscriber at the set top box.</p>								

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METHOD OF DELIVERING VIDEO INFORMATION  
OVER A TELECOMMUNICATIONS NETWORK

TECHNICAL FIELD OF THE INVENTION

5       The present invention relates in general to telecommunications signal processing and more particularly to a method of delivering video information over a telecommunications network.

BACKGROUND OF THE INVENTION

10       In typical telecommunications networks, a central point or administrative unit is notified whenever a request is made by a subscriber. These requests to a central point require a certain amount of bandwidth for proper delivery. For the delivery of video information within the telecommunications network, many of the requests from subscribers would be simple channel changes. These requests  
15       for simple channel changes from a subscriber would far exceed the effective bandwidth capability for the telecommunications system. The telecommunications network would not be able to deliver these requests to or handle these requests at a central point. Therefore, it is  
20       desirable to decrease bandwidth requirements in a telecommunication network for the efficient delivery of video information.

SUMMARY OF THE INVENTION

From the foregoing, it may be appreciated that a need has arisen for a telecommunications network that effectively delivers video information. In accordance with the present invention, a method of delivering video information in a telecommunications network is provided that substantially eliminates or reduces disadvantages and problems associated with conventional video information distribution techniques.

According to an embodiment of the present invention, there is provided a method of delivering video information in a telecommunications network that includes receiving a request for a new video channel from a sender. The request is carried in an asynchronous transfer mode format having a virtual channel identifier associated with the sender. A determination is made whether the new video channel is available and authorized for the sender. If the new video channel is authorized but not available, steps are performed such that the new video channel becomes available. A reply is transmitted to the sender in asynchronous transfer mode format that includes the new video channel.

The present invention provides various technical advantages over conventional video distribution techniques. For example, one technical advantage is to effectively provide video information without unnecessary bandwidth usage, increasing message traffic, and excessive processor load. Another technical advantage is to provide video information only when a video channel has been requested. Other technical advantages are readily apparent to one skilled in the art from the following figures, description, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings, wherein like reference numerals represent like parts, in which:

The FIGURE illustrates a block diagram of a telecommunications network for delivering video information.

DETAILED DESCRIPTION OF THE INVENTION

The FIGURE shows a block diagram of a video telecommunications delivery network 10. Video telecommunications delivery network 10 includes a plurality of video information providers 12 that each supply video information to an asynchronous transfer mode (ATM) switch 14. Video information is placed into an ATM cell format for routing by a digital multicast bank 16. Digital multicast bank 16 transfers video information in ATM cells to a plurality of cell routing units 18. In turn, each cell routing unit transfers video information in ATM cells to a plurality of cell multiplexing units 20 in the vicinity of video subscribers. Each cell multiplexing unit 20 provides the ATM cell based video information to a plurality of set top units 22 at the video subscriber locations.

Delivery of video information begins at a set top unit 22 where a video subscriber desires a specific video channel by number or the next higher or lower video channel. Each set top unit 22 has a pre-assigned virtual circuit identifier (VCI) for sending video channel requests to a respective cell multiplexing unit 20. Cell multiplexing unit 20 receives a request from set top unit 22 over an AAL5 port capable of receiving channel change

message requests from a plurality of virtual circuits. Cell multiplexing unit 20 interprets the request from set top unit 22, skipping over channels not currently authorized for channel up or down requests and initiating an authorization procedure for channels specifically requested but not currently authorized. If the requested channel is already being received at cell multiplexing unit 20, the program stream for the video channel is delivered on a VCI which is specified in the reply to the video channel request. Each video channel received at cell multiplexing unit 20 is assigned a dedicated VCI. Cell multiplexing unit 20 translates this VCI to the VCI specified to set top unit 22 currently receiving the video channel.

If the requested video channel is not being received at cell multiplexing unit 20, the video channel request is sent to cell routing unit 18 from cell multiplexing unit 20 over an internal AAL5 link. If currently being received, cell routing unit 18 sends the requested video channel to cell multiplexing unit 20. Cell multiplexing unit 20 does not send another video channel request to cell routing unit 18 until a previous request has been acknowledged and responded. Cell multiplexing unit 20 maintains a record of the last video channel requested by a set top unit 22. In this manner, if video channel requests are not readily serviced, a response to only the most recent video channel request need be performed.

If the requested video channel is not being received at cell routing unit 18, the video channel request is sent from cell routing unit 18 to digital multicast bank 16 over an internal AAL5 link. If currently being received, digital multicast bank 16 sends the requested video channel to cell routing unit 18. If the requested video channel is not being received, digital multicast bank 16 sends the



video channel request to an appropriate video information provider 12 as routed by ATM switch 14. If point to multi-point calling is implemented, the video channel request becomes an add party request to the ATM address corresponding to the video channel requested. If point to multi-point calls are not implemented, the video channel request becomes a point to point call to the ATM address corresponding to the video channel requested.

When a new video channel is requested, the delivery of the old video channel to the set top unit 22 of the video subscriber needs to be terminated. Cell multiplexing unit 20 maintains a count of the number of set top units 22 watching each active video channel and the number of video channels currently being received. When the number of set top units 22 providing a specific video channel to the video subscribers reaches zero, the specific video channel is linked to a list of video channels to be deleted. Once the number of video channels being received at cell multiplexing unit 20 exceeds a desired threshold, cell multiplexing unit 20 sends a delete request to its cell routing unit 18 to delete the video channel which has been on the channels to be deleted list the longest.

In order to deliver a requested video channel to a video subscriber, the requested video channel must be authorized for receipt by the video subscriber. Cell multiplexing unit 20 receives the video channel request from the appropriate set top unit 22 and initiates the authorization process. The cell multiplexing unit passes the video channel request to the cell routing unit 18. The cell routing unit 18 does not honor the request and returns a response to set top unit 22 indicating an identity of cell routing unit 18, an identity of set top unit 22, and the ATM address for the serving video information provider

12. Set top unit 22 proceeds to place an authorization call to the serving video information provider 12 that is routed through video telecommunications delivery network 10. The authorization call includes the identity of set top unit 22 and the identity of its associated cell routing unit 18.

When an authorization call is received, video information provider 12 determines the identity of set top unit 22 and determines which video channels set top unit 22 is authorized to receive. Video information provider 12 proceeds to place an authorization update call to the cell routing unit 18 associated with the requesting set top unit 22. The authorization update call includes the identity of set top unit 22, the ATM address for set top unit 22, and the video channels authorized to set top unit 22. For on-demand video requests, the authorization update call also may include a specific video channel to be initially sent to set top unit 22. Set top unit 22 would request any one of a plurality of on-demand video channels and video information provider 12 responds with an authorization update and a particular channel which is appropriate at the time for starting the on-demand program.

Cell routing unit 18 receives the data packet of the authorization update call from video information provider 12. Cell routing unit 18 determines which video information provider 12 is updating authorizations and requests the ATM address of the requesting set top unit 22. Cell routing unit 18 validates the authorization update by comparing the ATM address for set top unit 22 received from video information provider 12 with the ATM address for set top unit 22 received from set top unit 22. Validating authorization updates guards against authorization requests which contain incorrect network identifications or set top unit identification information. Upon validation, cell

routing unit updates the authorization for requesting set top unit 22 using the validated information. If no new video channel requests have been received by cell routing unit 18, the particular video channel determined by video information provider 12 is delivered to requesting set top unit 22. Cell routing unit 18 returns a validation response to video information provider 12. If validation was successful, video information provider 12 updates a video channel authorization list for requested set top unit 24.

Thus, it is apparent that there has been provided, in accordance with the present invention, a video telecommunications delivery network and method that satisfies the advantages set forth above. Although the present invention has been described in detail, it should be understood that various changes, substitutions, and alterations readily ascertainable by one skilled in the art may be made herein without departing from the spirit and scope of the present invention as defined by the following claims.

WHAT IS CLAIMED IS:

1. A method of delivering video information in a telecommunications network, comprising steps of:

5 receiving a request for a new video channel from a sender, the request being carried in asynchronous transfer mode format having a virtual circuit identifier associated with the sender of the request;

determining whether the new video channel is authorized for the sender;

10 determining whether the new video channel is available;

transmitting to the sender a reply to the request, the reply being in asynchronous transfer mode format having the virtual circuit identifier associated with the sender and including the new video channel.

2. The method of Claim 1, further comprising steps of:

20 receiving a plurality of video channels from a video source, each video circuit being assigned a unique virtual channel identifier;

translating the unique virtual circuit identifier of the new video channel into the virtual circuit identifier associated with the sender.

25

3. The method of Claim 1, further comprising a step of:

30 transmitting a message requesting the new video channel upon an indication that the new video channel is not available.

4. The method of Claim 3, further comprising a step of:

receiving the new video channel in response to the message.

5

5. The method of Claim 1, further comprising steps of:

tracking requests received from the sender;

discarding all requests but a most recent request;

10 processing the most recent request from the sender.

6. The method of Claim 1, further comprising a step of:

15 terminating transmission of an old video channel upon transmission of the new video channel.

7. The method of Claim 2, further comprising a step of:

20 placing unused video channels into a termination list.

8. The method of Claim 7, further comprising a step of:

determining whether a number of video channels in the termination list exceeds a threshold level;

25 transmitting a message to request terminating receipt of an oldest video channel within the termination list in response to the number of video channels in the termination list exceeding the threshold level.

9. The method of Claim 1, wherein the request for a new video channel includes a channel up or down request and further comprising steps of:

5 interpreting the request as an adjacent authorized higher or lower channel, respectively;

skipping over channels not currently authorized.

10. The method of Claim 1, further comprising a step of:

10 performing an authorization update in response to a request for a new video channel not being authorized for the sender.

11. A telecommunications network for delivering video information, comprising:

a video information provider operable to generate video information;

5 a telecommunications switch operable to receive video information from the video information provider, the telecommunication switch operable to place the video information into asynchronous transfer mode format, the video information being partitioned into a plurality of  
10 video channels;

a digital multi-cast bank operable to receive selected video channels from the telecommunications switch;

a cell routing unit operable to receive selected video channels from the digital multi-cast bank, the digital  
15 multi-cast bank operable to provide selected video channels to a plurality of cell routing units;

a cell multiplexing unit operable to receive selected video channels from the cell routing unit, the cell routing unit operable to provide selected video channels to a  
20 plurality pf cell multiplexing units;

a set top unit operable to request and receive a desired video channel from the cell multiplexing unit, the cell multiplexing unit operable to provide the desired video channel to at least one of a plurality of set top  
25 units upon request.

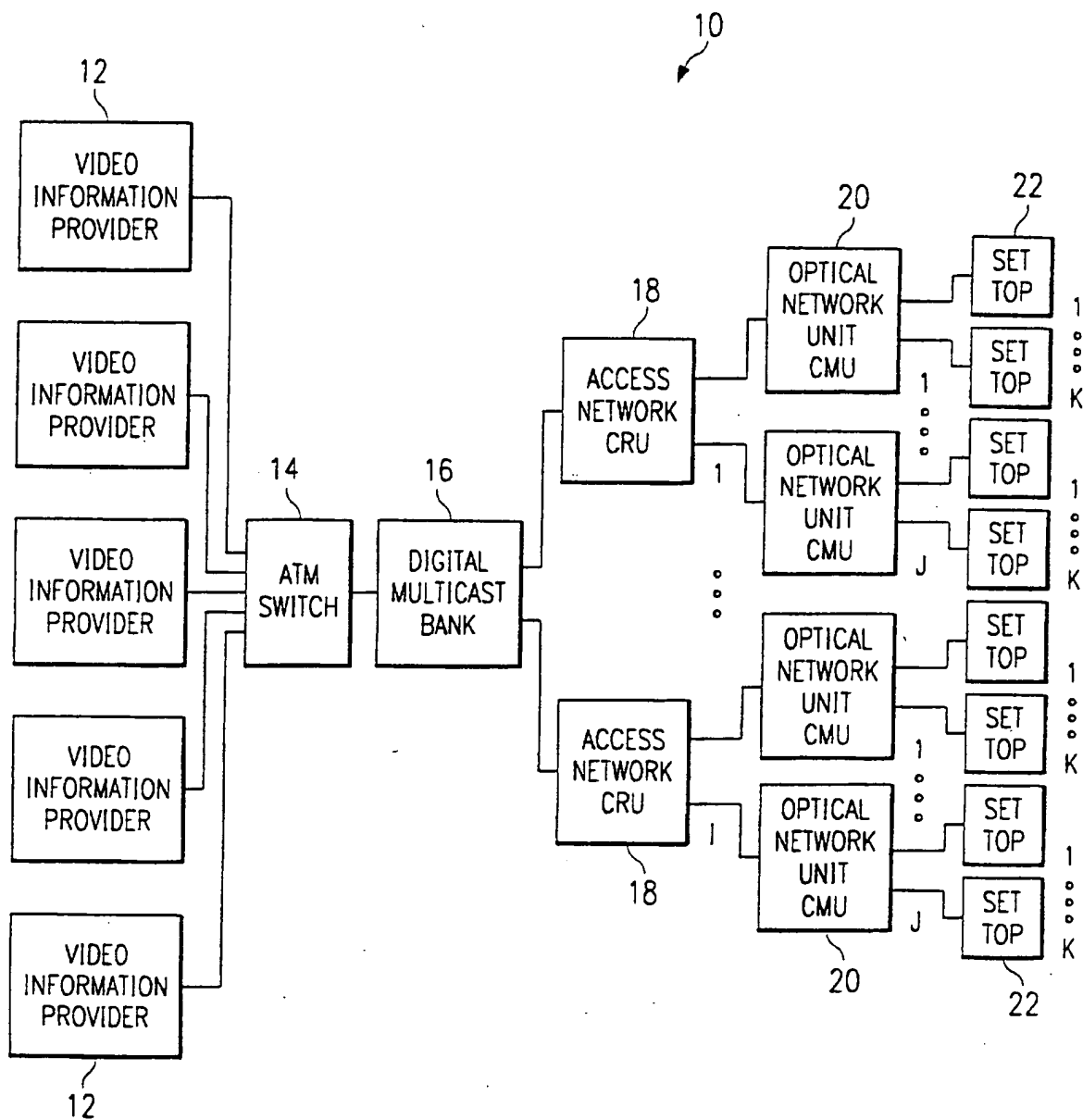
12. The telecommunications network of Claim 11, wherein the cell multiplexing unit validates a new video channel request from the set top unit, the cell multiplexing unit providing a new video channel to the set top unit upon validation of the new video channel request, the cell multiplexing unit passing the new video channel request to the cell routing unit if the new video channel is not available to the cell multiplexing unit.

13. The telecommunication network of Claim 11, wherein the set top unit and each video channel is assigned a unique virtual circuit identifier, the cell multiplexing unit translating a virtual circuit identifier field of the asynchronous transfer mode format from a virtual circuit identifier of the desired video channel to the virtual circuit identifier of the set top unit.

14. The telecommunications network of Claim 11, wherein the cell multiplexing unit maintains a record of the video channels provided by the cell routing unit that are not currently requested by a set top unit, the cell multiplexing unit generating a termination request in response to a number of video channels in the record exceeding a threshold level, the termination request being sent to the cell routing unit in order to cease transmission to the cell multiplexing unit of an oldest video channel in the record.



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# INTERNATIONAL SEARCH REPORT

Inter. Appl. Application No

PCT/US 97/15446

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04N H04L H04Q H04J G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 95 30305 A (AT & T CORP) 9 November 1995	1
A	see page 4, line 8 - page 8, line 28 ---	2-14
Y	CHANG Y -H: "AN OPEN-SYSTEMS APPROACH TO VIDEO ON DEMAND" IEEE COMMUNICATIONS MAGAZINE, vol. 32, no. 5, 1 May 1994, pages 68-80, XP000451097	1
A	see page 71, right-hand column, line 65 - page 74, left-hand column, line 38 ---	2-14
Y	EP 0 614 324 A (NIPPON ELECTRIC CO) 7 September 1994 see abstract --- -/-	11

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

17 November 1997

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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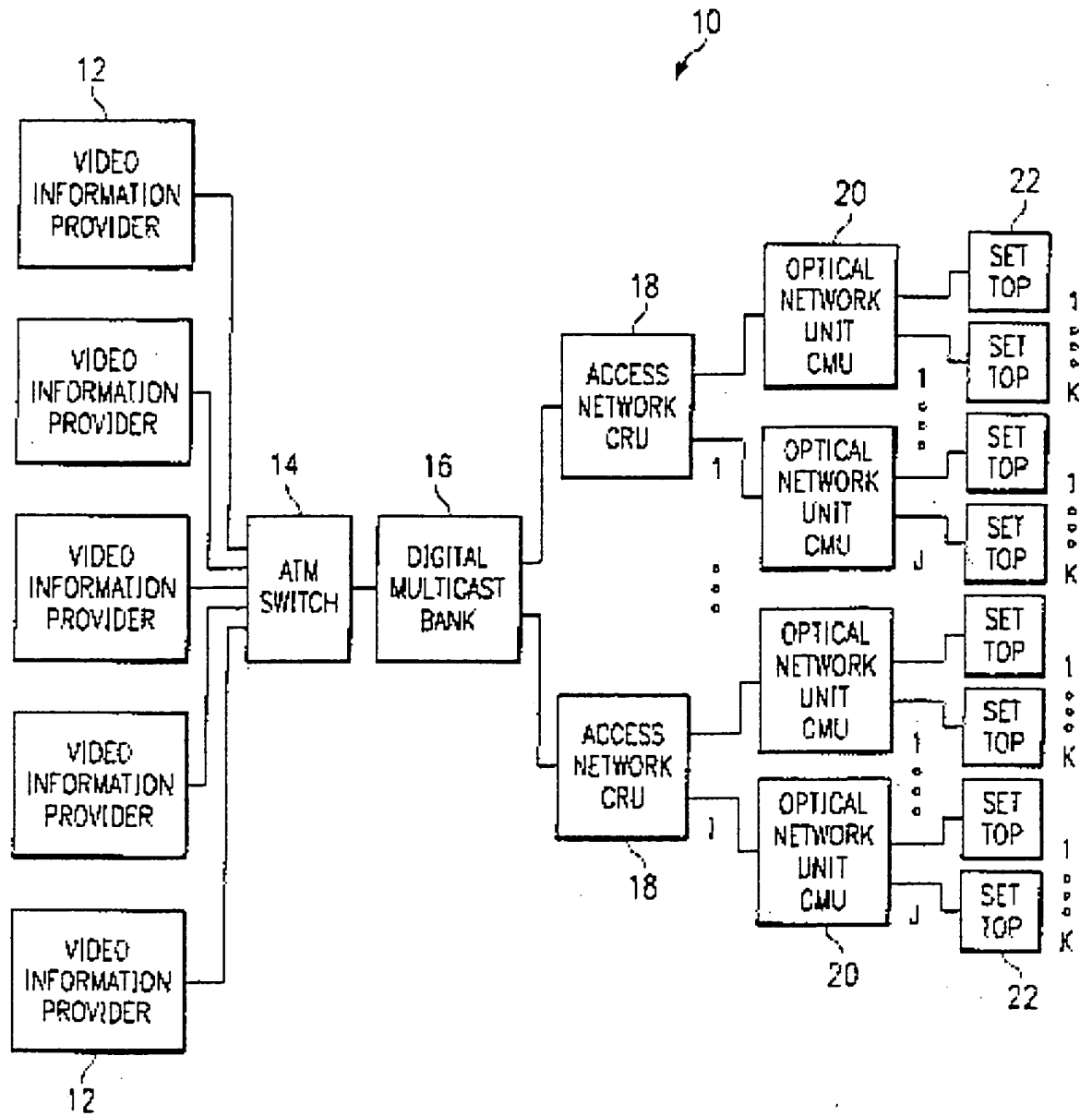
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